

A Tool for Medical Research



HEADING A SELECTION OF SPINOFFS IN
HEALTH AND MEDICINE IS AN INSTRUMENT
PLAYING A VITAL ROLE IN RESEARCH ON
AIRBORNE DISEASE TRANSMISSION

Aerosols are tiny solid particles or liquid droplets deposited in the atmosphere by natural events or human activities. In a hospital operating room

environment, they pose a potential danger: they may be sources of disease transmission.

The AIDS epidemic has focused attention on the various possible routes by which the HIV (human immunodeficiency virus) is transmitted. One route identified is through inhalation of aerosols that contain blood, generated in health care settings where bleeding occurs, such as surgery or dental procedures. When such particles are inhaled and penetrate deeply into the respiratory tract, they have potential for spreading the HIV and other disease bearing organisms and thus pose a threat to health care personnel.

In 1988, Dr. Don L. Jewett, Head of the Special Studies Unit, Department of Orthopaedic Surgery, Medical Center of the University of California at San Francisco, initiated a research project to broaden understanding of the formation and character of aerosol particles in the medical environment.

The Jewett team sought answers to some specific questions:

**A SYSTEM FOR ANALYZING ATMOSPHERES OFFERS
SPECIAL UTILITY IN MEDICAL/DENTAL INVESTIGATIONS**

- What types of aerosols are generated during different surgical procedures?
- What are the size ranges and mass concentrations of the particles?
- Do the particles contain blood and are health care personnel

adequately protected from inhaling them?

To get the answers, Dr. Jewett needed a versatile instrument. It must not only be capable of measuring particle mass concentrations and size distributions, but must also be able to retain samples for later analysis to determine whether they contain blood. He found such an instrument already in existence, in active use as an aerosol analyzer for air pollution studies, and commercially available from California Measurements, Inc., Sierra Madre, California.

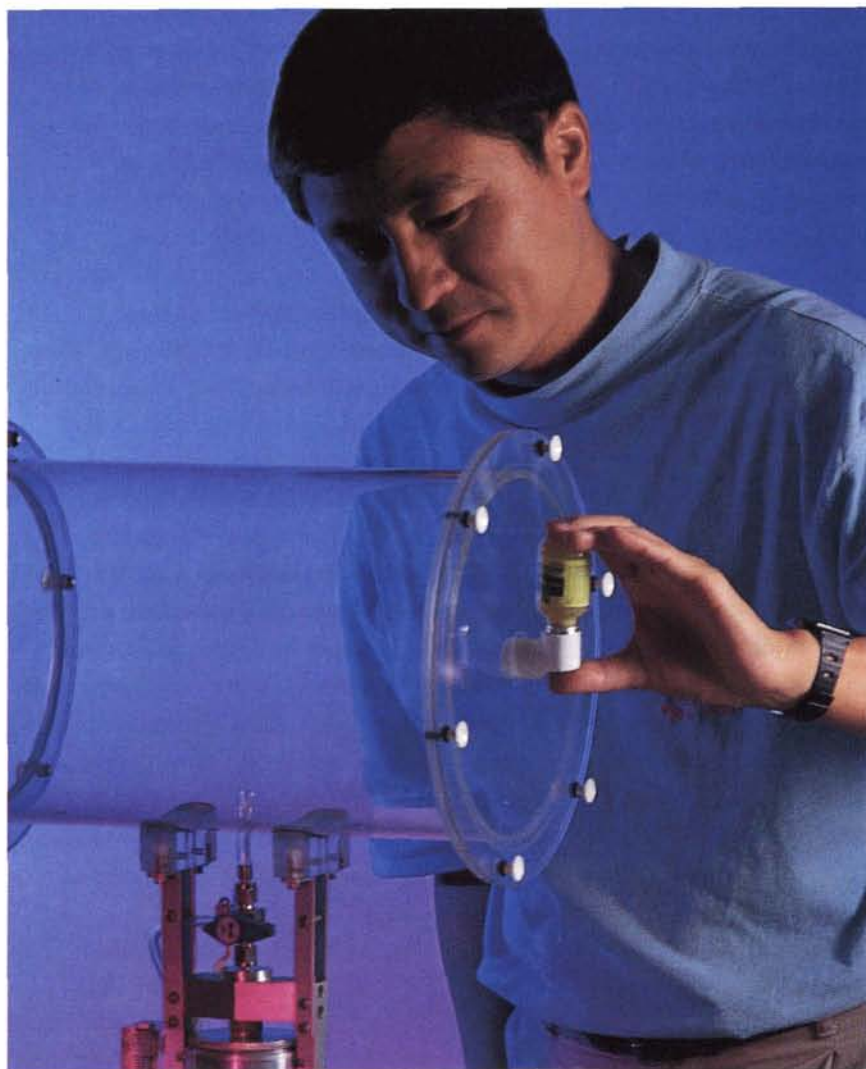
Known as the PC-2 Aerosol Particle Analyzer, the instrument incorporates technology developed by Jet Propulsion Laboratory (JPL) to determine the sizes and quantities of aerosols in the atmosphere at a particular time. The technology employs a dual-crystal sensor whose oscillating frequency changes in direct proportion to the amount of mass

collected on the sensor. Electronic processing of the frequency changes provides mass collection data in real time.

William Chiang, a former JPL engineer, founded California Measurements and obtained a NASA license for the JPL crystal oscillator technology. With Langley Research Center, he developed a particle analyzer for NASA use; later the company produced a modified PC-2 for commercial applications, such as atmospheric research, studies of smoke particles in fires, and environmental health research. It is also useful in testing filters for safety masks and in medical research related to drug delivery by inhalation.

William Chiang, president and founder of California Measurements, Inc., looks over the design of a customized version of his company's PC-2 aerosol particle analyzer, which is based on NASA technology.





Engineer Tom Chen is testing the size of particles dispensed by a commercially available inhaler. California Measurements' spinoff particle analyzer has a number of important applications in medical, atmospheric and environmental health research.

Dr. Jewett's team used a PC-2H 10-Stage Aerosol Analyzer as their primary research tool. It enabled measurement of particle sizes over the entire breatheable range and determination — in real time — of mass concentrations for each size. With this instrument, the team was able to get multiple sets of data repeatedly and accurately in short intervals during an experiment.

Dr. Jewett's conclusions, widely disseminated through technical forums since 1989, were that significant amounts of aerosols are indeed generated during surgeries where power tools are employed; most of the particles are in the respirable size range; almost all particles tested positive for blood or hemoglobin content; and ordinary surgical masks do not provide adequate protection. Further research is planned to answer the big question of whether the HIV and other viruses can be transmitted by aerosols, and the PC-2 analyzer will again play a central role.

Dr. Robert L. Miller, an Arizona dentist and aerobiologist, also used the PC-2H in research to determine the presence of blood aerosols during oral surgery and other dental procedures involving use of

power tools. His findings paralleled those of the Jewett team. Dr. Miller, who has accomplished considerable research of this type, states that the PC-2H detected large amounts of submicron-size blood plasma particles that in earlier research had escaped detection because they simply passed through conventional particle samplers.

In a letter to California Measurements, Dr. Miller wrote:

"The PC-2H has made a quantum leap forward in dental microbiology possible. Without this instrument, my work would have been abandoned and again dental aerosols would have gone undetected. Your instrument will be required to capture and quantify airborne virus when we become equipped to safely study blood aerosols containing the AIDS virus. The future quantitation of dental blood aerosols may become one of the most significant spinoffs of NASA technology." •